AB-14 - Paper

Validation of psychological predictors in the Swedish Enlistment System

Berit Carlstedt
National Defence College
Sweden

A validation study of psychological predictors used at the enlistment of Swedish conscripts was performed. The sample studied (n = 15 200) was conscripts who had been tested with the new computerized Enlistment battery (CAT-SEB), taken in use 1994, and who had completed military service by summer 1997. Their military marks were used as criteria. The CAT-SEB was evaluated in terms of three latent variables: General ability, Verbal ability, and Spatial ability. Assessments of Leadership ability and Psychological functioning, made by psychologists, were also used as predictors. Two different methods of analysis were used, one regressing individual criterion results on individual predictor results. In the other method, the performance of candidate groups, formed by predictor results, was related to mean criterion performance of the groups. The latter method yielded more encouraging and interpretable results concerning the validity of the psychological predictors.

Enlistment of conscripts in Sweden takes place at the age of 18 and is compulsory for men. A few women, who can apply voluntarily, are enlisted each year. This paper reports a predictive validity study where performance results from completed basic military training were used as criteria.

METHOD

Predictor variables

The main parts of the enlistment procedure are an intelligence test, an interview by a psychologist, and physical and medical examination. The intelligence test is computerized, and contains 10 tests of verbal, spatial, and problem solving ability. The test results are evaluated in terms of three latent variables: General ability, Verbal ability (Gc) and Spatial ability (Gv). The two latter factors are residuals to the first (Mårdberg and Carlstedt, 1998). The variables of physical capacity are muscle strength, physical fitness, eyesight, and hearing. The medical examination results in a health classification, used primarily as a basis for the decision whether the conscript should do military service or not. The psychologist's interview yields an assessment of Psychological functioning ability of every conscript. Those who have reached the level of at least five on the stanine scale of General intelligence are also rated concerning Leadership ability.

The enlistment procedure aims at the classification of conscripts to all the different positions of the armed forces. At enlistment however, as much as 35% of the population are screened out. The psychologist's assessment as well as that of the medical doctor might result in an exemption from any kind of military service (this goes for about 1%). The other 34% are going to the training reserve and will be trained only if needed for military preparedness reasons. Thus, only about 65% of those coming to enlistment are selected for compulsory military service.

The first selection and its impact on the distributions of a few of the predictor variables are presented for another sample, enlisted in autumn 1997. The figures are fairly stable

over years.

Table 1. Proportion (%) of individuals per predictor variable level, exempted or placed in the training reserve. Numbers from enlistment in autumn 1997. n≈ 21 800.

Predictor variable	Predictor variable				
level	G	PF	LA	Phys	Musc
1	82	100	96	67	75
2	62	92	83	66	44
3	44	54	47	61	36
4	34	20	19	55	30
5	28	10	10	38	24
6	24	8	7	18	23
7	24	5	5	9	19
8	24	4	4	7	20
9	24	6	7	8	20

The variables most restricted in range after the first selection step are Psychological functioning (PF), Leadership ability (LA) and General ability (G).

The next step is the classification of individuals to different levels of duty. About 8% will become non-commissioned officers and be trained for 12-15 months to be in charge of units of platoon or company size (30 - 120 soldiers). Around 15 % will be trained for 10 months to become section leaders, in charge of 8 -10 soldiers. All these three categories are in the following analyses grouped under the NCO label. The rest are placed as privates in different duties with different demands on psychological and physical capacities. Privates have different training duration (8 - 10 months). They are assigned to different branches of the armed forces, and their training is planned to start one or two years after the enlistment.

Criterion variables

The validation sample contained 15.200 men (the few women were excluded) who had completed their military training in 1997 or earlier (29% had completed 1996). The available criteria were their military marks and what kind of duty the marks referred to (according to level and service). Two of the marks used for the validation purpose were Overall competence and Job knowledge. These marks certainly have shortcomings in reliability. They are assessed by many different instructors who work in many different environments, certainly having varying opinions of what is good performance. However, the validity of the criterion lies in the fact that it is used for decisions whether an individual after training will get a placement in the defense organization or not.

Every mark is set referring to a special duty in a special service. One way to handle this heterogeneity would be to separate the individuals from one duty of one company at a time to study the correlation between predictors and criteria. This would, however, result in too small groups for the statistical analyses. A more rough way of categorization was used here for criterion grouping: two levels of duty (NCO level and privates level) times three kinds of military service [Assisting combat (anti-aircraft and artillery), Combat (infantry, cavalry, and armor), and Support (communication, logistics, and engineer troops)].

One category that we had no knowledge about were those who had left their training in advance for psychological or medical reasons. This also applies for those who had been allowed to postpone their training for the reason that the training period would interfere too much with their university studies.

RESULTS

A description of the enlistment variables and the criterion variables for the two levels and the three kinds of services is displayed in Table 2.

Table 2. Means and standard deviations of enlistment variables and criterion variables.

	NCOs			Privates		
Enlistment variables	Assisting combat	Combat	Support	Assisting combat	Combat	Support
LA	5.93 (1.10)	6.01 (1.12)	5.78 (1.13)	4.69 (1.16)	4.87 (1.19)	4.89 (1.84)
PF	6.24 (1.19)	6.39 (1.16)	6.04 (1.18)	5.00 (1.25)	5.26 (1.32)	4.90 (1.26)
G	6.37 (1.38)	6.20 (1.39)	6.55 (1.39)	4.92 (1.74)	4.76 (1.69)	4.89 (1.84)
Gc	5.55 (1.93)	5.52 (1.89)	5.76 (1.88)	5.02 (1.93)	4.98 (1.88)	5.11 (1.87)
Gv	5.30 (1.75)	5.26 (1.82)	5.28 (1.82)	5.10 (1.96)	5.00 (2.00)	4.98 (1.90)
Phys	6.50 (1.33)	6.72 (1.37)	6.28 (1.34)	6.05 (1.32)	6.22 (1.38)	5.93 (1.30)
Musc	6.03 (1.89)	6.42 (1.87)	5.79 (2.05)	5.51 (1.96)	6.02 (1.93)	5.55 (1.98)
Sight	7.67 (1.64)	7.86 (1.60)	7.29 (1.74)	7.94 (1.56)	8.05 (1.49)	7.61 (1.67)
Hear	8.85 (0.56)	8.82 (0.62)	8.77 (0.75)	8.74 (0.72)	8.76 (0.71)	8.73 (0.73)
Time	1.05 (0.42)	1.10 (0.45)	1.03 (0.49)	0.97 (0.36)	1.04 (0.36)	1.04 (0.32)
Criterion variables						
Over	7.19 (1.07)	6.91(1.17)	7.20 (1.10)	6.82 (1.09)	7.14 (1.12)	6.84 (1.04)
Know	7.19 (1.01)	6.82 (1.08)	7.26 (0.96)	6.81 (1.00)	7.23 (0.97)	6.83 (0.97)
Passing (%)	70.5	72.0	69.7	55.9	56.6	57.7

G = general factor (from the CAT-SEB) stanine scale

Gc = verbal ability factor (residual factor " ") "

Gv = spatial ability factor (residual factor " ") "

LA = leadership ability (psychologist's rating) stanine scale

PF = psychological functioning (" ") "

Musc = muscle strength (stanine scale)

Phys = physical fitness (stanine scale)

Sight = eyesight (9=no impairment, 8=some impairment, etc.)

Hear = hearing (9=no impairment, 8=some impairment, etc.)

Time = time since enlistment (1 or 2 years)

Over = overall competence for the service (10-grade scale)

Know = job knowledge (" ")

Passing = percentage of military marks sufficient to apply for international peace keeping missions. Here is included a third military mark, called "general behavior".

■

The outcome of the classification is displayed in the table. NCOs have higher results on most of the predictor variables, especially so for the cognitive, the Psychological functioning, the Physical fitness, and Muscle strength variables. On the service level the Combat services have the highest capacities in the variables PF, Phys and Musc. Concerning the criteria, the military marks Overall competence and Job knowledge are also higher for the NCO level. The pass/fail criterion that includes a third variable, General behavior, yields the highest percentage of pass for NCOs of Combat services. The Gc and Gv variables were not used for the classification at that time.

The enlistment variables were regressed on the military marks (Overall competence and Job knowledge) for the six categories mentioned above. Table 3 reveals the results.

Table 3. Regression of predictor variables on the two military marks (Overall competence and Job knowledge) for the NCO and privates levels in the three types of services (Assisting combat, Combat and Support). Psychological variables bold.

Kind of military service and level		Overall competence		Job knowledge	
	n	***significant predictor***	***mult r***	***significant predictors***	***mult r***
NCO level					
Assisting combat	660	**LA**, **G**, Hear	.21	**LA**,**G**	.20
Combat	2728	**PF**, **G**, Hear, Phys, Musc, Time	.17	**LA**, **G**, Musc, Phys, Time, Gc	.19
Support	548	**PF**, Sight	.19	**PF**, Time, Sight	.25
Privates level					
Assisting combat	1669	**G**, **PF**, Hear, Phys, Musc, Time	.23	**G**, **PF**, Phys, **Gc**, **Gv**	.27
Combat	5207	**PF**, **G**, **Gv**, Musc, Phys, Sight	.21	**PF**, **G**, **Gv**, Musc, Phys, Sight, Hear	.22
Support	941	**PF**,**G**, Musc, Phys	.21	**PF**, **G**, Musc, Phys	.27

Statistically, the two military marks are highly intercorrelated (.74), but conceptually they seem to capture somewhat different things. Generally the coefficients are higher for Job knowledge than for Overall competence, probably due to higher reliability of the former assessment. The General intelligence factor has predictive value for all three kinds of service on the privates level, and for two kinds of services at the NCO level - not for the Support services. The PF variable although most restricted in range in the first selection step shows predictive validity for the two criteria and all three services for the privates level. At NCO level the PF variable has predictive validity for the Support services and for the criterion Overall competence for Combat services. The LA variable shows validity on the NCO level for the Assisting combat services, and for Job knowledge in the Combat services.

Elapsed time between enlistment and training has a significant correlation with the military marks for NCOs in Combat services. This may be brought about by the conscript getting a bit older and more mature and thus able to perform better in the NCO role.

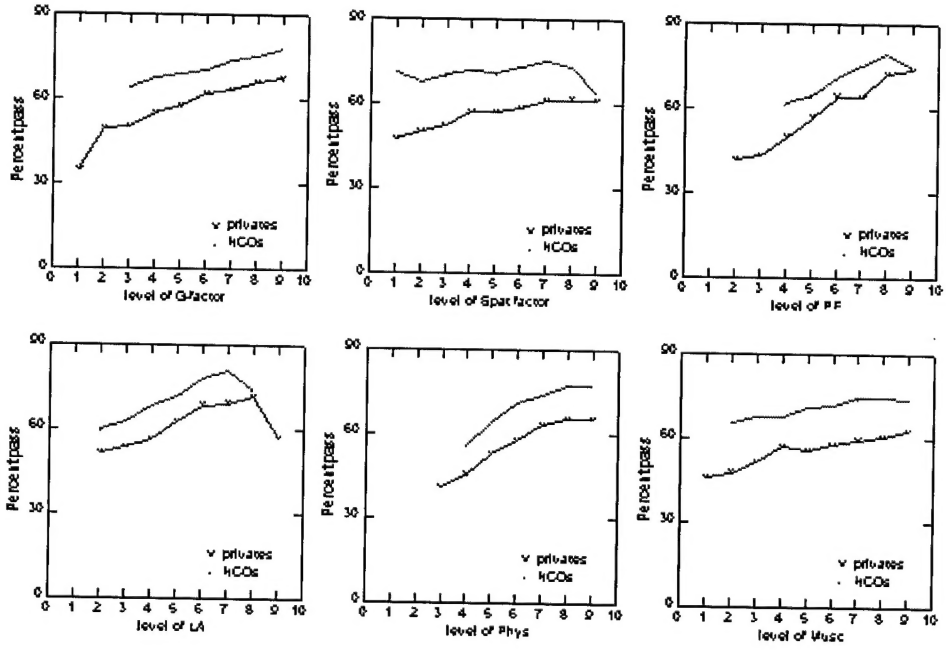
Although most of the predictor variables presented here are used first for the selection to military service at all and then for the decision of placement to different duties - and the categories presented thus are restricted in range - indications of validity of the predictors occur. The multiple correlations are, however, generally low and the common variance of the predictors and the criteria extremely low (3 - 7 % of the variance in common).

The so far presented validation results are based on individual results on predictors and criteria. Big systems like the enlistment system might, beside prediction of individual

results, also be interested in prediction of performance of groups of conscripts. An alternative method of analysis according to Lubinsky and Humphreys (1996) was used to display validation results. Criterion performance was studied for groups of conscripts whose scores on the selection instruments differed between groups but were equal within groups. Groups were thus generated by their results on the predictor variables.

In the present analyses the criterion variable was handled as follows. The military mark including three variables (beside Overall competence and Job knowledge, also General behavior) was dichotomized into pass/fail where pass was equal to or higher than the lowest military marks demanded from conscripts in order to apply for international peace-keeping missions. The results are presented as graphs with the levels of the predictor variable on the x-axis and the corresponding training result of each level on the y-axis. Figure 1 presents the percentage of "good" military marks on different levels of the enlistment variables General ability, Spatial ability, Psychological functioning, Leadership ability, Physical fitness and Muscle strength. NCOs' and privates' curves are presented separately, all services combined.

Figure 1. Criterion outcome per level of predictor variables G, Spat, PF, LA, Phys and Musc.



The curves are cut off at the lower levels – 1, 2 or even 3 – especially for the NCOs but also for Physical fitness for the privates. This is a result of the first selection, none or too few observations were found for those levels of the predictor variables. Generally the curves for NCOs are displayed at a higher level, indicating that the marks were generally higher for them than for privates. The General intelligence curves rise through all nine levels –for privates from 35% at G=1 to 68% at G=9. The NCO criterion result of G=9 is the highest of all predictor variables. The Verbal ability factor showed no validity for

either NCOs or privates (graph not presented). No rise of the NCO curve is observed for the Spatial ability factor and there is in fact a decline in proportion of pass for the highest Spatial ability level. However, for the privates the curve is rising through all the levels of the predictor. The steepest curves are observed for Psychological functioning of the privates category, while for NCOs a decline is observed for the highest predictor value. An even more accentuated decline is observed for both NCOs and privates in the highest scores of Leadership ability. Physical capacity shows a steep rise of both curves at least at medium predictor results, while Muscle strength shows a more moderately rising proportion of good military marks over the scale.

Interpretation of these graphs reveals some findings, that evokes some interesting questions. Why do those assessed best in Leadership ability not do as good as those assessed somewhat lower? What is the reason for the decline of the proportion of good military marks for NCOs with the best assessments of Psychological functioning? Is the Spatial ability factor only valid for privates´ jobs?

DISCUSSION

The results reveal the impact of the decisions made for about 35 percent of the population – not to do compulsory military service – the variables become restricted in range. The analyzed sample of conscripts is probably even further restricted in range, as only those who have completed their service is included. The results of the regression analyses of individual predictor and criterion results show validity coefficients at ordinary, rather low levels. They are also hard to interpret in terms of things to change in order to make the predictions better. The regression of group mean test results on group outcome, however, is easier to interpret and possibly easier to use for changes in predictor variables. The result, that the conscripts rated highest on Psychological functioning and Leadership ability perform worse than those rated somewhat lower, might be looked at from at least two points of view. Are the assessment criteria for the highest level of PF and the two highest levels of LA inadequate for the predictions to be made? Or is the training situation such that these persons' abilities are not taken advantage of to an appropriate extent? In conclusion, however, the enlistment variables studied are generally valid in predicting "good" military marks.

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